

Remarks

Upon entry of the foregoing amendment, claims 1-54 are pending in the application, with 1, 8, 13, 18, 22, 28, 36, 39, and 42 being the independent claims. Claims 1, 8, 13, 18, 22, 36, 39, and 42 are sought to be amended. Claims 28-30 are withdrawn. These changes are believed to introduce no new matter, and their entry is respectfully requested.

Based on the above amendment and the following remarks, Applicants respectfully request that the Examiner reconsider all outstanding objections and rejections and that they be withdrawn.

Objections to the Claims

The Examiner objected to claim 8 because "contacts" should be contact in line 4. Applicants have amended claim 8 accordingly.

Rejections under 35 U.S.C. § 102

The Examiner rejected claims 1 and 3-7 under 35 U.S.C. § 102(e) as being anticipated by U.S. Pat. No. 6,207,467 to Vaiyapuri et al. (hereinafter Vaiyapuri).

Applicants respectfully traverse this rejection. Claim 1, as amended, recites:

A substrate in an integrated circuit (IC) package, comprising:

opposing first and second surfaces, wherein one of said first and said second surfaces has a plurality of solder ball contacts pads formed thereon, wherein said first surface has a central opening,
wherein said central opening has an edge,
wherein said edge includes *at least one protruding edge portion that extends into said central opening to provide a non-linear edge substantially parallel to a plane of said first surface,*

whereby said at least one protruding edge portion provides a shorter distance between a trace on said first surface and an IC die relative to a distance between the trace and the IC die when said at least one protruding edge portion is not present.

Vaiyapuri describes a multi-chip module with stacked dice. The module includes a multi-cavity structure, having a set of three cavities: a lowermost cavity, a vertically upwardly displaced cavity, and an uppermost cavity. Thus, the cavities, which become progressively larger from bottom to top, define a plurality of steps in the sidewalls of the structure. (Vaiyapuri, col. 2, lines 19-27). Nothing in Vaiyapuri teaches or suggests an edge including *at least one protruding edge portion that extends into said central opening to provide a non-linear edge substantially parallel to a plane of said first surface*, as set forth in independent claim 1, as amended.

Claims 3-7 also distinguish over Vaiyapuri for reasons similar to those set forth above with respect to independent claim 1, as amended, and further in view of their own features.

The Examiner rejected claims 8, 9, 11, 12, 22-25, 32, 35, 47, 48, 53, and 54 under 35 U.S.C. § 102(e) as being anticipated by U.S. Pat. No. 6,664,617 to Siu (hereinafter Siu). Applicants respectfully traverse this rejection. Claim 8, as amended, recites:

A substrate in an integrated circuit (IC) package, comprising:

opposing first and second surfaces, wherein one of said first and said second surfaces has a plurality of solder ball contact pads formed thereon, wherein said first surface has a central opening, wherein said central opening has an edge, wherein said edge includes *at least one recessed edge portion to provide a non-linear edge substantially parallel to a plane of said first surface*, whereby said at least one recessed edge portion provides access to a portion of a surface of a stiffener attached to the substrate relative to when the at least one recessed edge portion is not present.

Siu describes a semiconductor package including a metal foil, which is folded at the central portion to form a rectangular central recess surrounded by a flat and extended border region. (Siu, col. 4, lines 7-15). A substrate is functionally attached to and covering the front surface of the border region of the metal foil, which is formed with a central opening to expose the recess. (Siu, col. 4, lines 45-48). Nothing in Siu teaches or suggests an edge including *at least one recessed edge portion to provide a non-linear edge substantially parallel to a plane of said first surface*, as set forth in independent claim 8, as amended.

Claim 22, as amended, recites:

An integrated circuit (IC) package, comprising:

a substrate that has opposing first and second surfaces, wherein one of said first and said second surfaces has a plurality of solder ball contact pads formed thereon, wherein said first surface has a central opening;

a stiffener that has a first surface, wherein said first surface of said stiffener has a central bondable ring, wherein said first surface of said stiffener is attached to said substrate;

wherein said central opening has an edge, wherein said edge includes at least one of:

(a) a protruding edge portion that extends across at least a portion of said central ground ring *to provide a non-linear edge substantially parallel to a plane of said first surface*,

(b) a recessed edge portion that exposes a portion of said central ground ring *to provide a non-linear edge substantially parallel to a plane of said first surface*, or

(c) *a hole proximate to said edge, wherein the hole exposes a portion of said central ground ring.*

Claim 22, as amended, also distinguishes over Siu for reasons set forth above with respect to independent claim 8, as amended. Moreover, Siu fails to teach or suggest a recessed edge portion that exposes a portion of said central ground ring *to provide a non-linear edge substantially parallel to a plane of said first surface* or *a hole proximate*

to said edge, wherein the hole exposes a portion of said central ground ring, as set forth in independent claim 22, as amended.

Claims 9, 11, 12, 23-25, 32, 35, 47, 48, 53, and 54 also distinguish over Siu for reasons similar to those set forth above with respect to independent claims 8 and 22, both as amended, and further in view of their own features.

Rejections under 35 U.S.C. § 103

The Examiner rejected claims 10, 18-21, 26, 27, 34, 39-41, 51, and 52 under 35 U.S.C. § 103(a) as being unpatentable over Siu in view of U.S. Pat. App. No. 2002/0171144 to Zhang et al. (hereinafter Zhang). Applicants respectfully traverse this rejection. Claim 18, as amended, recites:

A substrate in an integrated circuit (IC) package, comprising:

opposing first and second surfaces, wherein one of said first and said second surfaces has a plurality of solder ball contacts pads formed thereon, wherein *said first surface of the substrate has a central opening, wherein said central opening has a non-linear edge extending substantially parallel to a plane of said first surface or said second surface;*

a first trace on said first surface of the substrate proximate to a first portion of said non-linear edge;

a second trace on said first surface of the substrate proximate to a second portion of said non-linear edge;

wherein the substrate is capable of being coupled to a surface of a stiffener that has a central bondable ring, wherein said first portion of said non-linear edge is configured to cover a first portion of the central bondable ring when the substrate is coupled to the surface of the stiffener, and said second portion of said non-linear edge is configured to expose a second portion of the central bondable ring when the substrate is coupled to the surface of the stiffener;

whereby said first portion of said non-linear edge allows for a shorter distance between said first trace and an IC die relative to a distance between said second trace and the IC die.

Siu fails to teach each and every element recited in independent claim 18, as amended. More specifically, Siu fails to teach or suggest that *said first surface of the substrate has a central opening, wherein said central opening has a non-linear edge.*

Furthermore, Zhang does not provide the missing teachings.

Independent claim 39, as amended, also distinguishes over Siu and Zhang for reasons similar to those set forth with respect to independent claim 18, as amended.

Claims 10, 19-21, 26, 27, 34, 40, 41, 51, and 52 also distinguish over Siu and Zhang for reasons similar to those set forth above with respect to independent claims 18 and 39, both as amended, and further in view of their own features.

The Examiner rejected claims 13, 16, and 17 under 35 U.S.C. § 103(a) as being unpatentable over Siu in view of U.S. Pat. No. 6,057,601 to Lau et al. (hereinafter Lau). Applicants respectfully traverse this rejection. Claim 13, as amended, recites:

A substrate in an integrated circuit (IC) package, comprising:

opposing first and second surfaces, wherein one of said first and said second surfaces has a plurality of solder ball contacts pads formed thereon, wherein said first surface has a central opening,
wherein said central opening has an edge,
wherein said first surface includes at least one hole proximate to said edge,
whereby said at least one hole proximate to said edge is capable of providing access for a bond wire to a portion of a surface of a stiffener attached to the substrate relative to when the at least one hole proximate to said edge is not present.

The Examiner concedes that Siu and Zhang fails to teach the first surface including at least one hole proximate to the edge, whereby the at least one hole proximate to the edge provides access to a portion of a surfaced of a stiffener attached to the substrate relative to when the at least one hole proximate to the edge is not present.

Lau fails to remedy the failure of Siu and Zhang to teach that *at least one hole proximate to said edge* (of the central opening of the first surface) *is capable of providing access for a bond wire to a portion of a surface of a stiffener attached to the substrate relative to when the at least one hole proximate to said edge is not present.*

The Office Action relies on element 187 of Lau to allegedly teach a hole that provides access to a portion of a surface of a stiffener. However, the specification of Lau does not describe element 187 at all. Nevertheless, element 187 is not a hole that is

capable of providing access for a bond wire to a portion of a surface of a stiffener.

Instead, element 187 is apparently merely a via, such as ground via 202 shown in FIG.

2B of the present patent application or vias 75, 80, or 85 shown in FIG. 1B of Lau. Lau explains:

The ground ring 30 and the power ring 35 are connected (sic) to a ground plane 65 and a power plane 70 respectively formed beneath the bottom surface of the substrate 12 through a ground via-connection via 75 and a power via connection 80 respectively punched through the substrate 12. The ground plane 65 and the power plane 70 are then interconnected to the balls 60 through another set of via-connections 85 disposed near the peripheral of the substrate 12. (Lau, col. 2, lines 24-32).

The via 187 of Lau is not capable of providing access for a bond wire to a portion of a surface of a stiffener. Thus, Siu, Zhang, and Lau, alone or in combination, fail to teach each and every element of independent claim 13, as amended. Claims 16 and 17 also distinguish over the cited art for reasons similar to those set forth above with respect to independent claim 13, as amended, and further in view of their own features.

The Examiner rejected claims 2, 31, 36-38, 45, and 46 under 35 U.S.C. § 103(a) as being obvious over Siu and Zhang in view of Vaiyapuri. Applicants respectfully traverse this rejection. Claim 36, as amended, recites:

An integrated circuit (IC) package, comprising:

a stiffener that has a first surface, wherein said first surface of said stiffener has a central bondable ring;

an IC die mounted to said first surface of said stiffener within said central bondable ring; and

a substrate that has opposing first and second surfaces, wherein said first surface of said substrate has a plurality of solder ball contact pads formed thereon, wherein said first surface of said stiffener is attached to said second surface of said substrate, wherein said substrate has a central opening that is open at said first and said second surfaces of said substrate, wherein the central opening accommodates said IC die;

wherein said central opening has a non-linear edge substantially parallel to a plane of said first surface of said substrate, wherein said non-linear edge has a protruding edge portion that extends across a portion of said central bondable

ring, wherein a trace on said first surface of said substrate extends into said protruding edge portion;

whereby said protruding edge portion provides a shorter distance between said trace and said IC die relative a distance between said trace and said IC die when said protruding edge portion is not present.

Siu, Zhang, and Vaiyapuri, alone or in combination, fail to teach or suggest that *said central opening has a non-linear edge substantially parallel to a plane of said first surface of said substrate*, as set forth in independent claim 36, as amended.

Claims 2, 31, 37, 38, 45, and 46 also distinguish over the cited art for reasons similar to those set forth above with respect to independent claim 36, as amended, and further in view of their own features.

The Examiner rejected claims 14, 15, 33, 42-44, 49, and 50 under 35 U.S.C. § 103(a) as being obvious over Siu and Zhang in view of Lau. Applicants respectfully traverse this rejection. Claim 42, as amended, recites:

An integrated circuit (IC) package, comprising:

a stiffener that has a first surface, wherein said first surface of said stiffener has a central bondable ring;

an IC die mounted to said first surface of said stiffener within said central bondable ring; and

a substrate that has opposing first and second surfaces, wherein said first surface of said substrate has a plurality of solder ball contact pads formed thereon, wherein said first surface of said stiffener is attached to said second surface of said substrate, wherein said substrate has a central opening that is open at said first surface and said second surface of said substrate, wherein said central opening accommodates said IC die, wherein said first surface of said substrate has a hole proximate to an edge of said central opening;

wherein said hole exposes a portion of said central bondable ring;

whereby *said hole is capable of providing access for a bond wire to said portion of said central bondable ring that would not be accessible when said hole is not present.*

The Office Action relies on element 187 of Lau to allegedly teach a hole configured to allow a corresponding bond wire to couple an IC die mounted on the

surface of the stiffener. However, element 187 is not a hole that is *capable of providing access for a bond wire to said portion of said central bondable ring*. Instead, element 187 is apparently merely a via, such as ground via 202 shown in FIG. 2B of the present patent application or vias 75, 80, or 85 shown in FIG. 1B of Lau.

Thus, Siu, Zhang, and Lau, alone or in combination, fail to teach each and every element of independent claim 42, as amended. Claims 14, 15, 33, 43, 44, 49, and 50 also distinguish over the cited art for reasons similar to those set forth above with respect to independent claim 42, as amended, and further in view of their own features.

Conclusion

All of the stated grounds of objection and rejection have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider all presently outstanding objections and rejections and that they be withdrawn. Applicants believe that a full and complete reply has been made to the outstanding Office Action and, as such, the present application is in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

Prompt and favorable consideration of this Amendment and Reply is respectfully requested.

Respectfully submitted,

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